Climatic variability of the thermohaline structure of the Arctic Ocean surface layer and its conditioning factors

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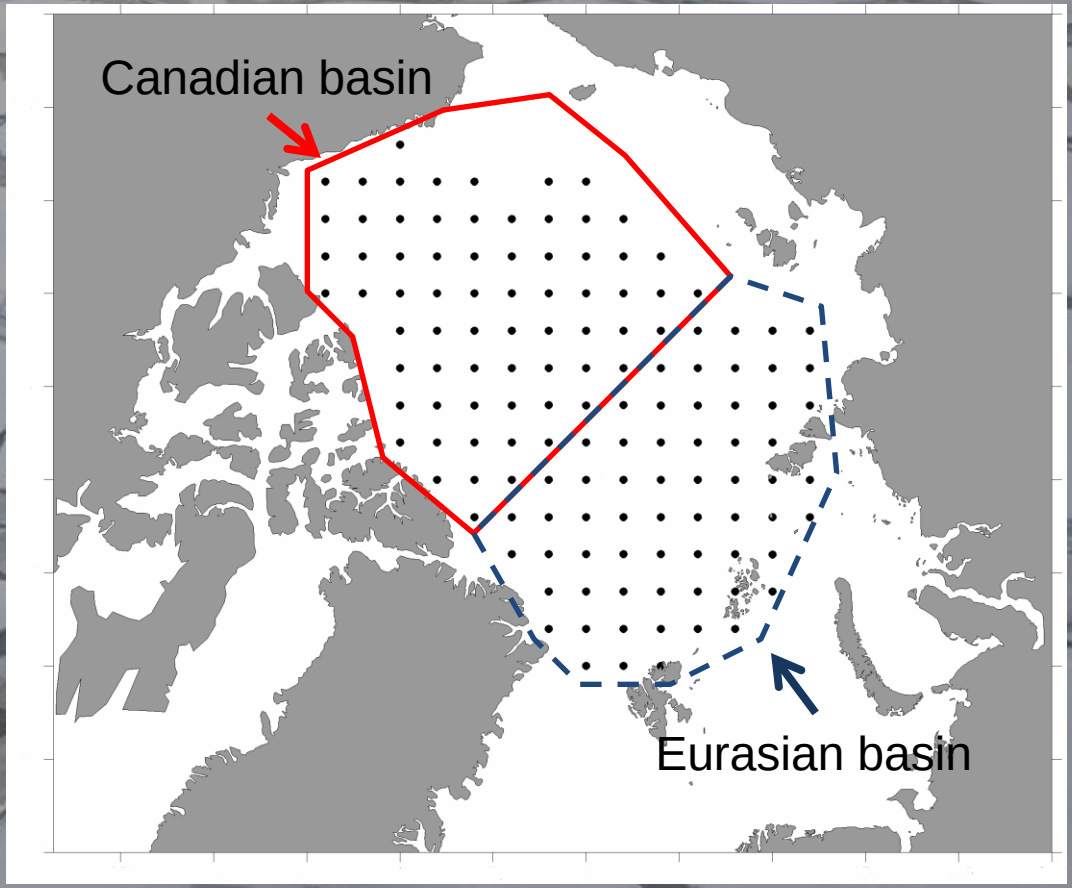
Source data and research area

- Joint U.S. Russian Atlas of the Arctic Ocean for winter.

- Atlas contains gridded data of historical oceanographic observations at standard horizons (5, 10, 25, 50, 75, 100, 150, 200 m and so on) for the period of 1950-1993 obtained during expeditions in the Arctic.

- Gridded salinity and temperature data obtained during winter expeditions of 2007-2010 or received from ITP-buoys.

- Data is represented in regular grid 200x200 km (over 130 nodes).



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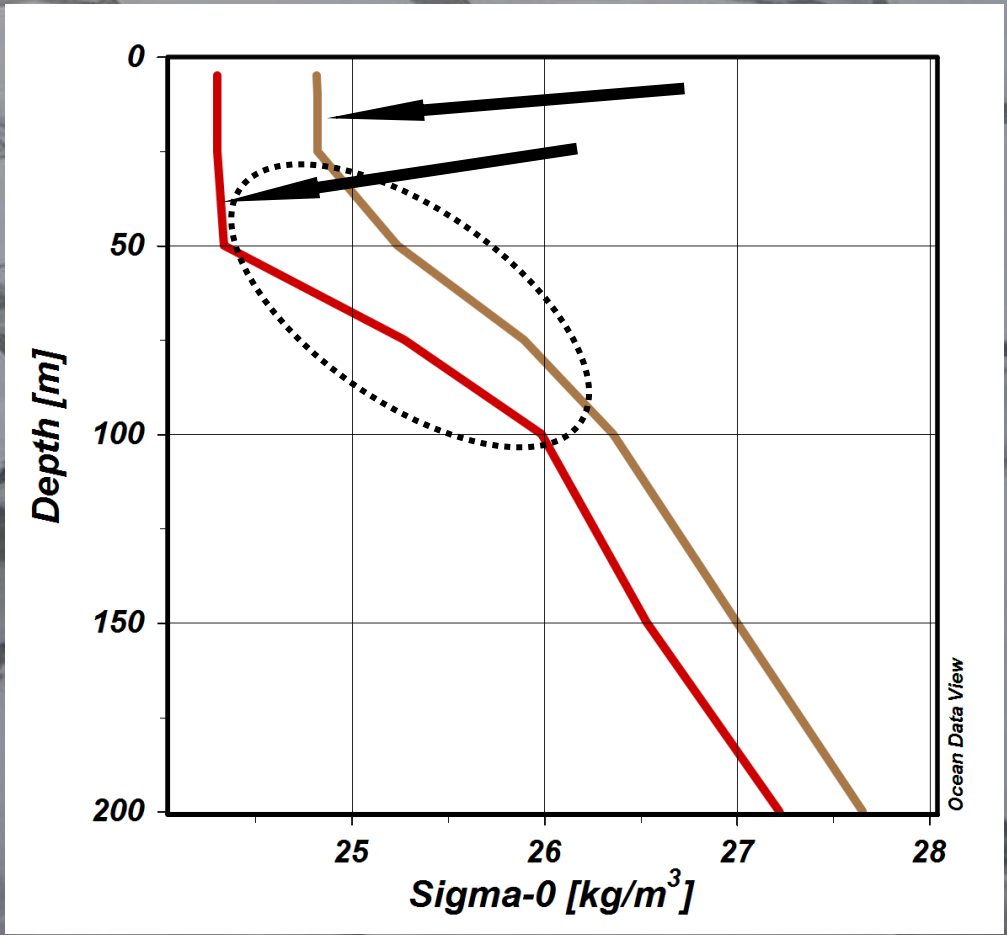
Arctic Ocean surface layer

Surface layer of the Arctic Ocean occupies space from the ocean surface down to 10-40 m depth in summer and to 25-100 m in winter.

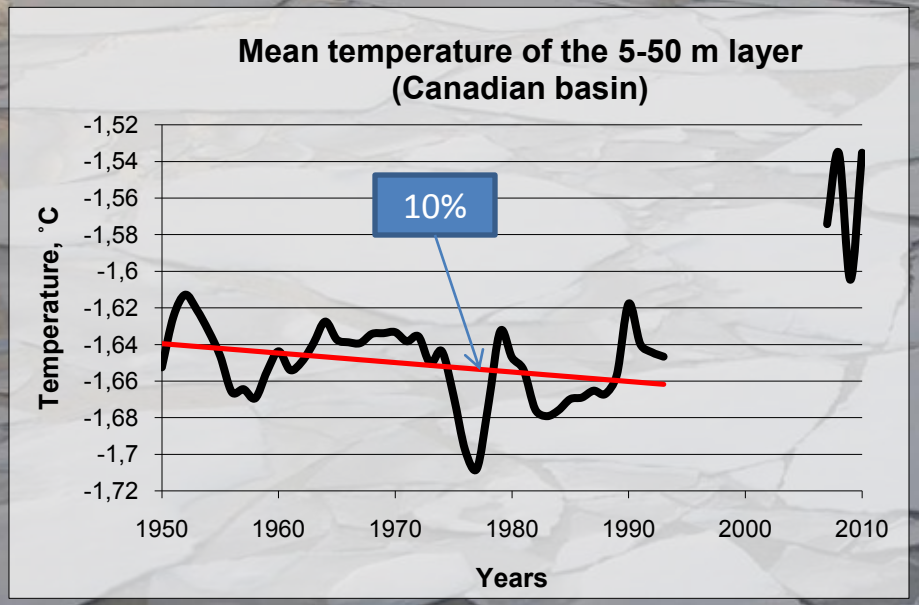
Surface layer include:

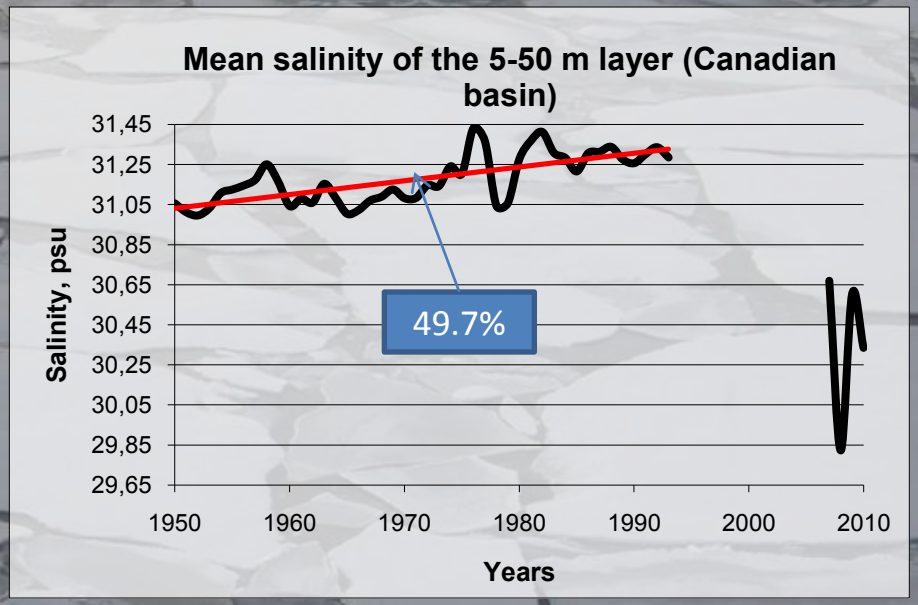
- mixed layer

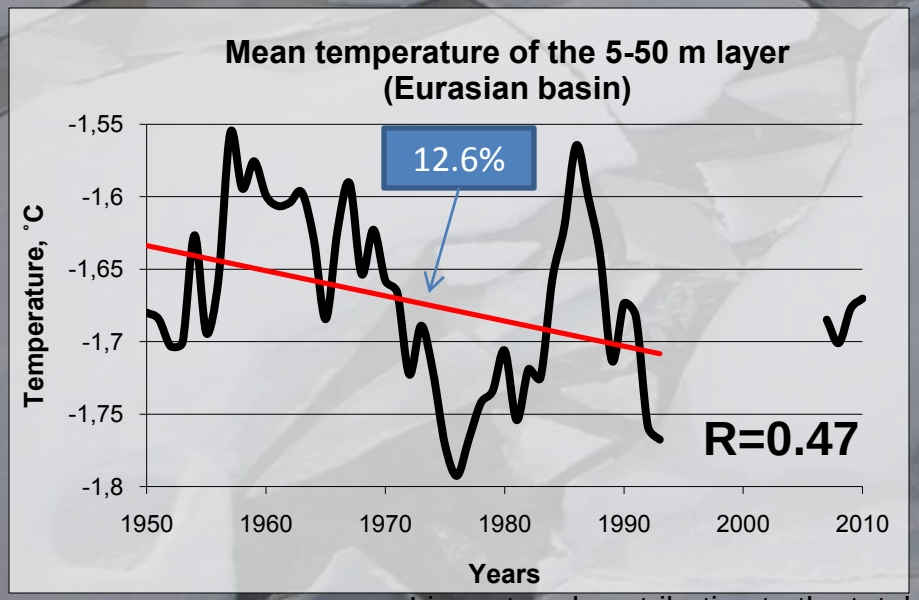
- pycnocline

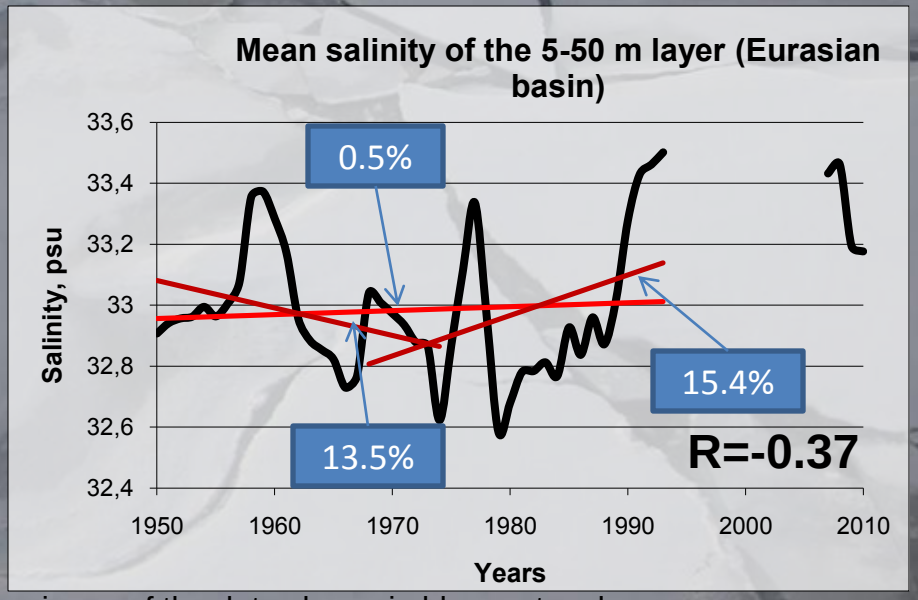


Temporal variability of mean temperature and mean salinity of 5-50 m layer for Canadian and Eurasian basins



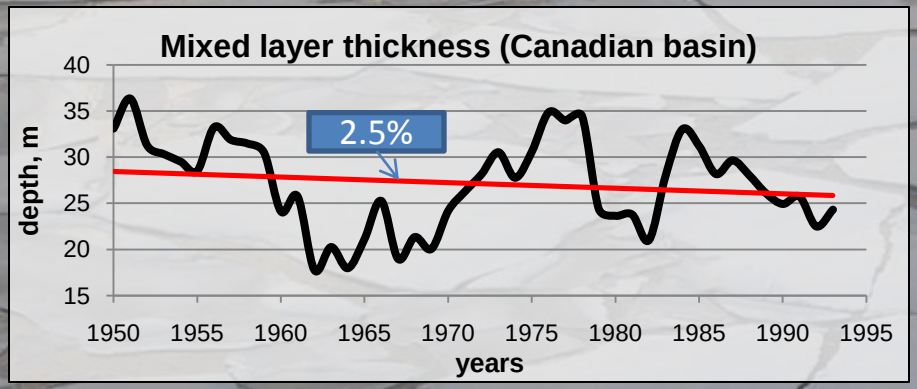


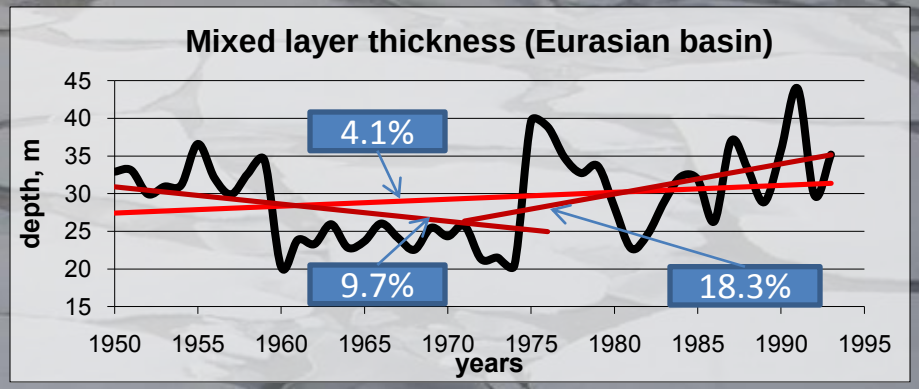


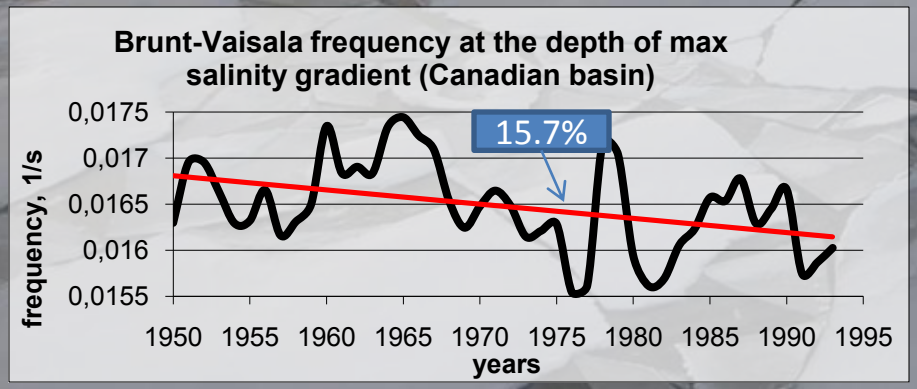


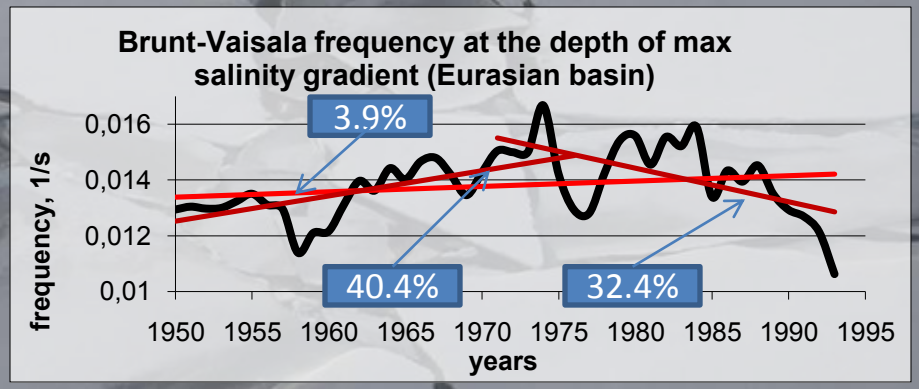
Linear trend contribution to the total variance of the data shown in blue rectangles

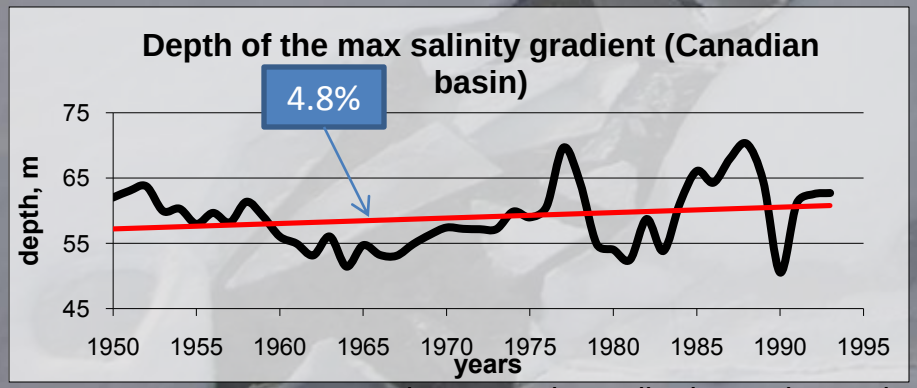
Temporal variability of surface layer parameters for Canadian and Eurasian basins

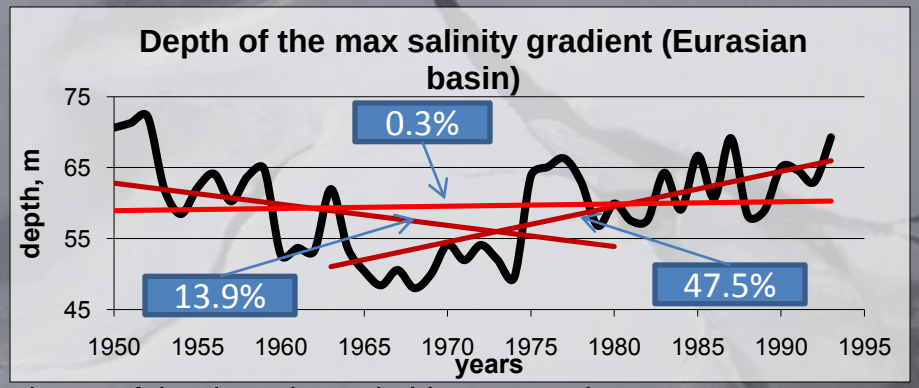








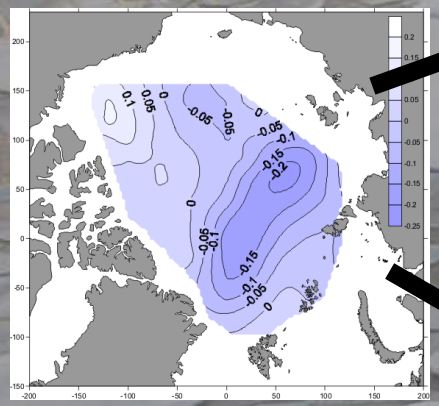


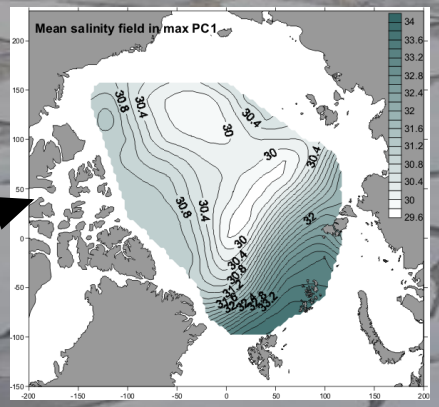


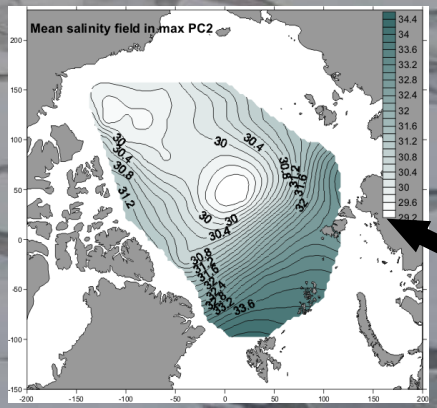
Linear trend contribution to the total variance of the data shown in blue rectangles

Decomposition of mean salinity of 5-50 m layer on EOF

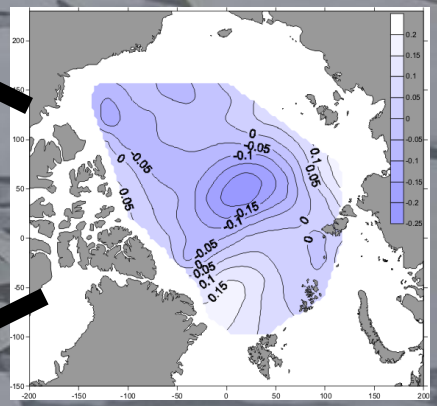
1st mode (39%)

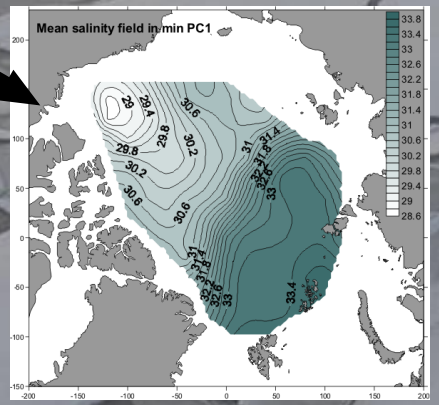


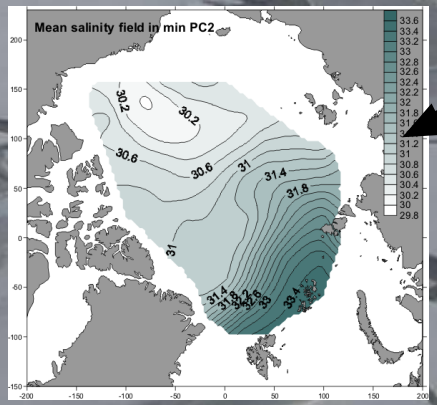




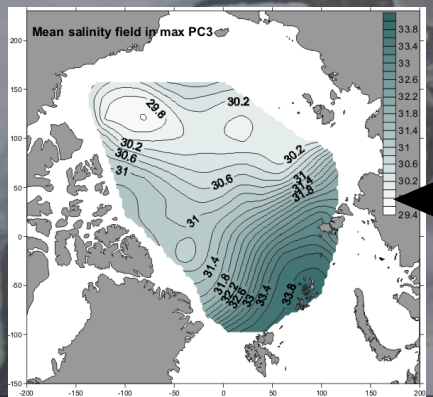
2nd mode (12.4%)

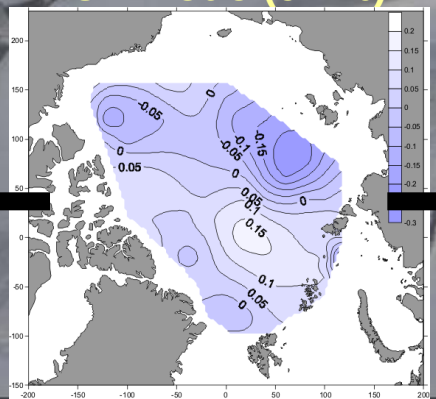


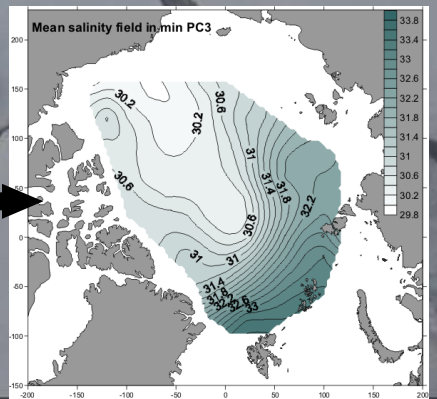




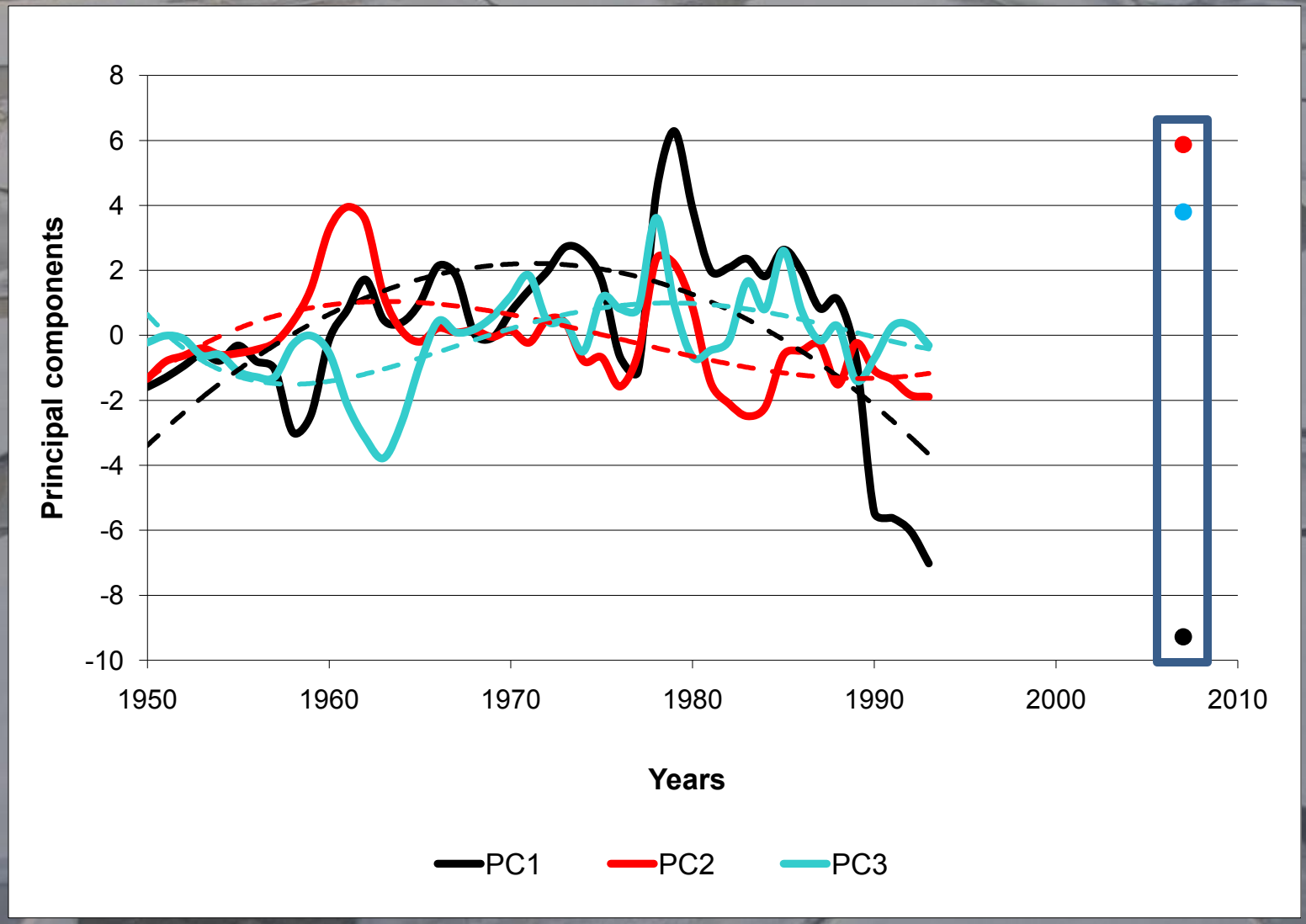
3rd mode (9.1%)



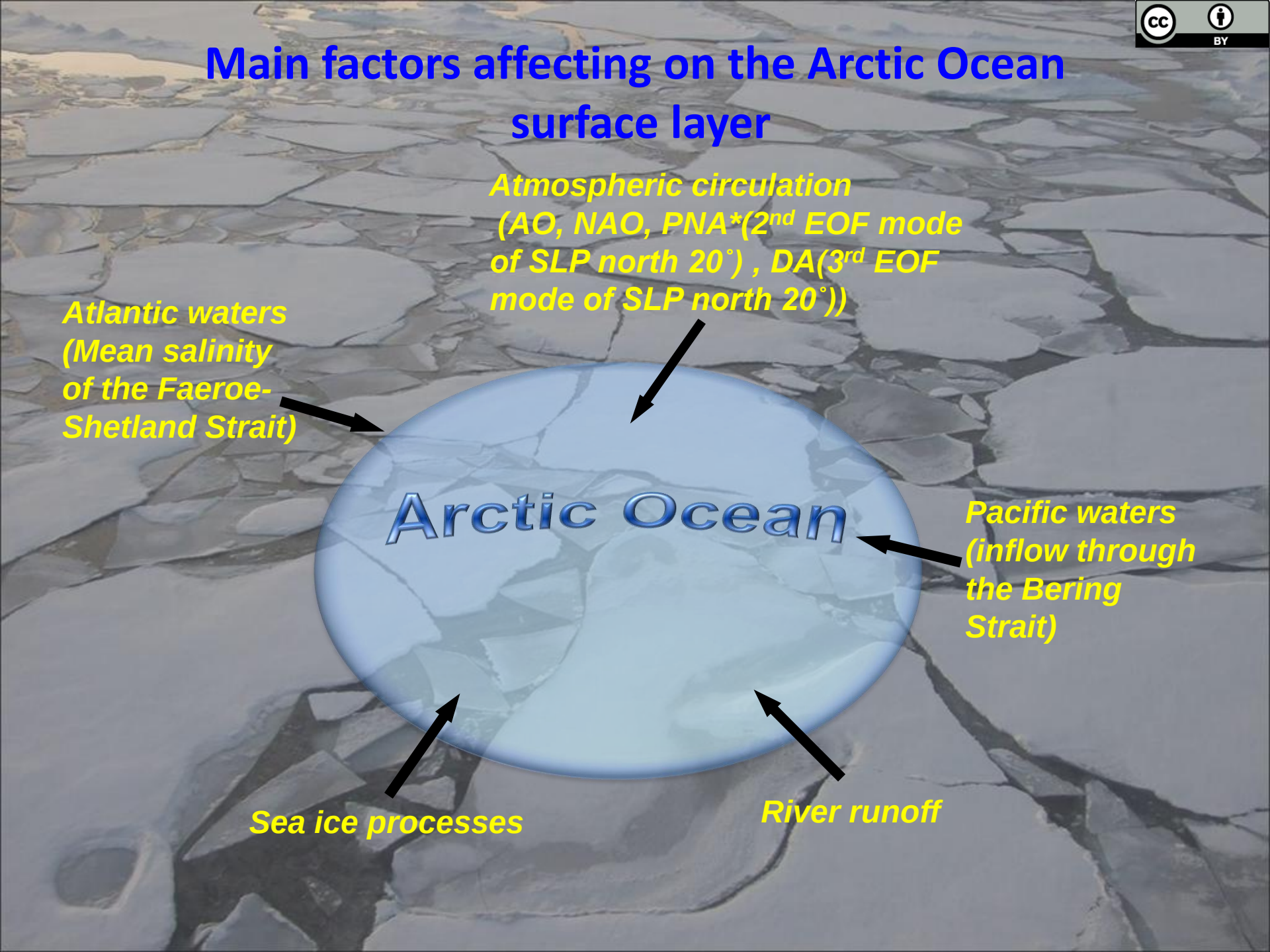




Temporal variability of EOF principal components of mean surface salinity



Main factors affecting on the Arctic Ocean surface layer



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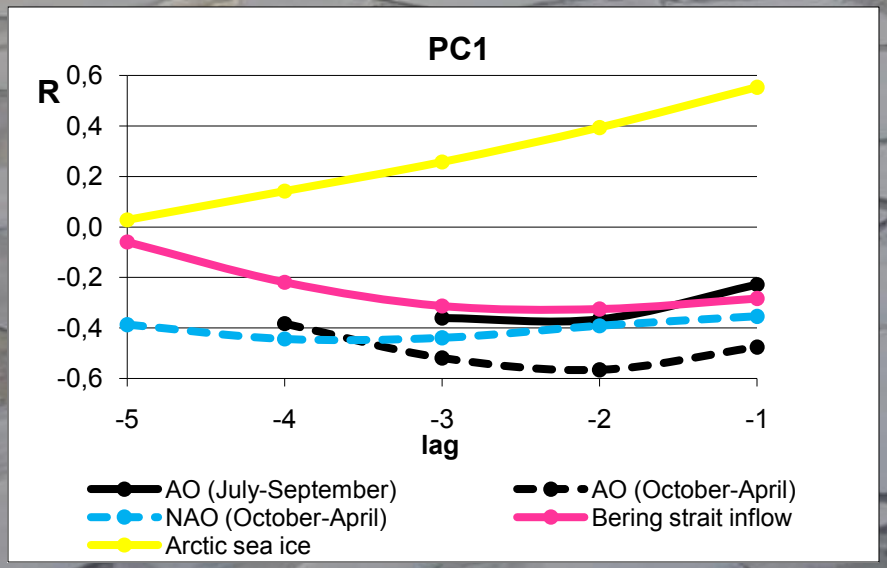
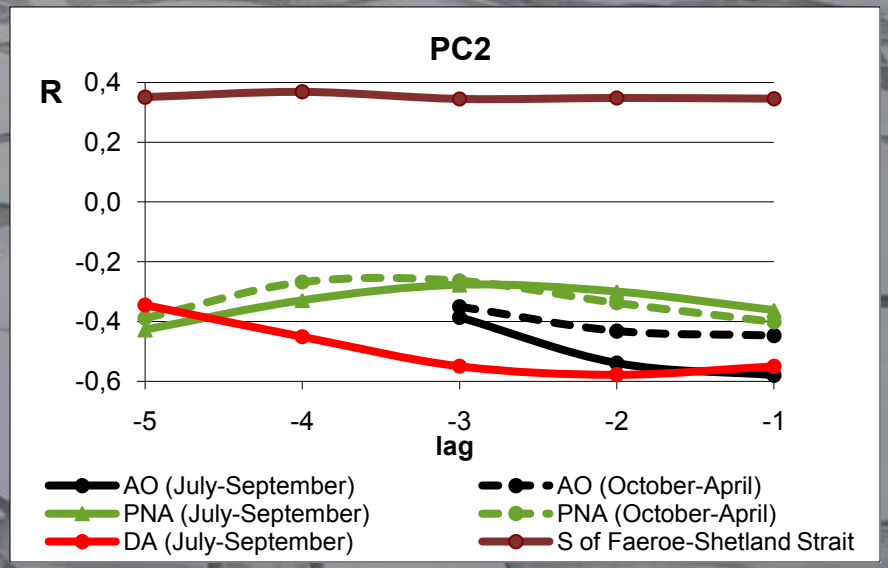
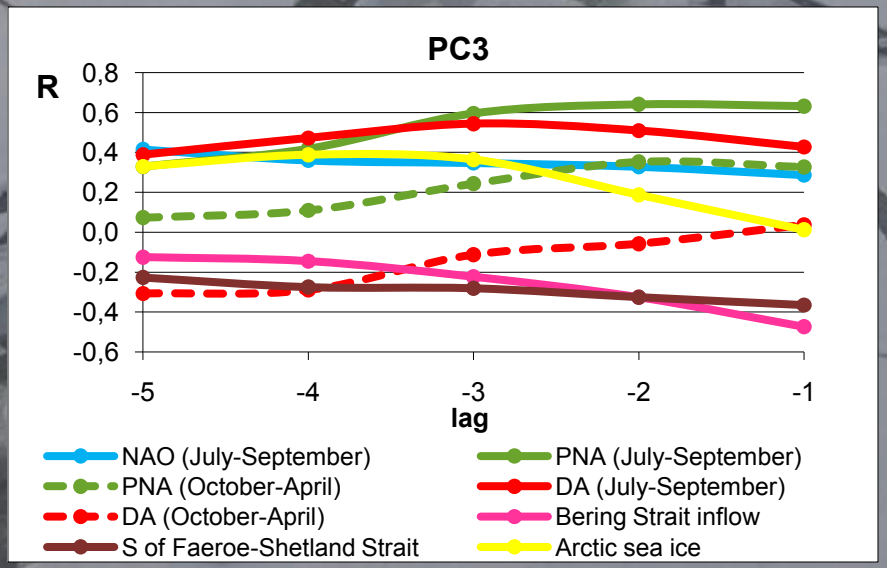
Results of correlation analysis of surface layer salinity







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SUMMARY

- Temperature decreases and salinity increases in the surface layer of the Canadian Basin and Eurasian Basin over the winter period of 1950-1993. The significant freshening and warming of the Canadian Basin surface layer is observed since 2007;
- Cycles with the periods of around 7, 17, 25 and 34 years were distinguished in the time series of EOF principal components of surface salinity decomposition. Analysis of the time series of principal components showed significant differences in the surface layer salinity structure between the winter periods of 2007-2008 and 1950-1993;
- The highest correlations were obtained between mean July-September PNA* index and the salinity PC3 (0.64), between mean July-September DA index and PC2 (-0.58) and between mean October-April AO index and PC1(-0.57);
- The significant correlations were found with the lags of 1-3 years, i.e. the structure of the surface layer salinity depends not only on the atmospheric processes in the previous few months, but also on the atmospheric processes that took place 1-3 years ago.
- High correlations (above |0.5|) were also revealed with ice cover of the Arctic seas and river runoff.

Thanks for your attention !

Acknowledgments:

Лаборатория им. Отто Шмидта

Otto-Schmidt Labor

Meeting Organizer
Copernicus Office